NAVAL AIR MATERIAL CENTER

PHILADELPHIA 12, PA.

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JUL 7 1958

From: Commanding Officer, Naval Air Material Center
To: Chief, Bureau of Aeronautics (AE-415)

Subj: TED NAM AE 4195; Evaluation of Experimental X2020 Aluminum High Temperature Alloy; Report No. NAMC-AML-AE 4195, Part I, Response to Anodizing and Compatibility with Magnesium

Ref: (a) BUAER ltr Aer-AE-415/342 of 4 Nov 1957

Encl: (1) Details and Results of Laboratory Experiments on X2020 Aluminum Alloy concerning Response to Anodizing and Compatibility with Magnesium

1. Reference (a) requested an evaluation of the experimental aluminum alloy X2020. The information requested in reference (a), concerning response to anodizing and compatibility with magnesium, is reported in enclosure (1).

2. Results indicate that the time necessary to produce equivalent anodic coating weights is greater for the X2020 alloy than for 2024 or 7075. Therefore, the time of anodizing the X2020 should be 10-15 minutes longer than that used for 2024.

3. Only slight differences are apparent with the three alloys when coupled to AZ31B magnesium alloy. Corrosion current and weight loss measurements are somewhat lower with the X2020, but the differences are not significant.

4. This is a partial report under the subject project. Work is continuing on the other phases authorized by reference (a).

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By direction

(11 Earn J. Ketelaar)

25 JUNE 1958

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REPORT NO. NAMC-AML-AE 4195 PART-I

DETAILS AND RESULTS OF LABORATORY EXPERIMENTS ON X2020 ALUMINUM ALLOY CONCERNING RESPONSE TO ANODIZING AND COMPATIBILITY WITH MAGNESIUM

A. PURPOSE

A new high temperature aluminum alloy X2020 is being evaluated for use in naval aircraft applications. Response to anodizing and compatibility with magnesium in galvanic couples has been determined.

B. TEST METHODS

1. The response of the X2020 to anodizing was compared with that of 2024-T3 and 7075-T6. Panels were anodized in chromic acid at 40 volts for 30 minutes at 95°F. Coating weights were determined by weighing the panels, stripping the coatings in a chromic-phosphoric acid solution at 180°F for 10 minutes, and reweighing the panels.

2. Solution potential values were measured on the three alloys listed above in 1N NaCl at room temperature against a saturated calomel reference electrode. Duration of the experiments was approximately two hours in order to obtain steady state values.

3. Compatibility of the three alloys with magnesium was determined by coupling equal areas of each alloy to AZ31B magnesium alloy, measuring corrosion currents over a 48-hour period, and calculating the weight loss suffered by the magnesium as anode.

C. RESULTS

1. Anodic coating weights obtained on the three alloys were as follows:

Alloy	Coating Weights (mgms/sq ft)	
	Individual Measurements	Average
X2020	212, 240, 220	224
2024-T3	355, 310, 330	332
7075-T6	470, 436, 449	452

Obviously, the X2020 alloy anodizes more slowly than the other two alloys. Since X2020 in the as-received conditions appears to have a heavy oxide film on the surface, the possibility that this was delaying the formation

of the anodized film was considered. A deoxidizing step, consisting of a 5-minute immersion in Diversey 514 prior to anodizing, was included in the process, but these panels had the same coating weight as the panels that were not deoxidized.

2. Steady state solution potentials of the three alloys are as follows:

7075 - .75 volts
X2020 - .72 volts
2024 - .60 volts

3. The trend of corrosion current measurements of 2024, X2020, and 7075 coupled to AZ31B magnesium alloy were similar. The current between the magnesium alloy and the X2020 is between that of 7075 and 2024 for the first 100 minutes, but is somewhat lower for the remainder of the 48-hour test period. The weight losses resulting on the magnesium specimens over a 48-hour period were as follows:

Aluminum	Weight Loss on Magnesium
X2020	50%
7075-T6	57%
2024-T3	58%

Therefore, as indicated by the corrosion current and weight loss measurements, the X2020 alloy is somewhat more compatible with magnesium than are the other two aluminum alloys, but the difference is slight.

D. CONCLUSIONS

1. Longer anodizing time should be used for the X2020 alloy than is used for 2024 and 7075 alloys in order to achieve equivalent weight.

2. X2020 alloy, when coupled to magnesium, will behave in a manner similar to 2024 and 7075 alloys.

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